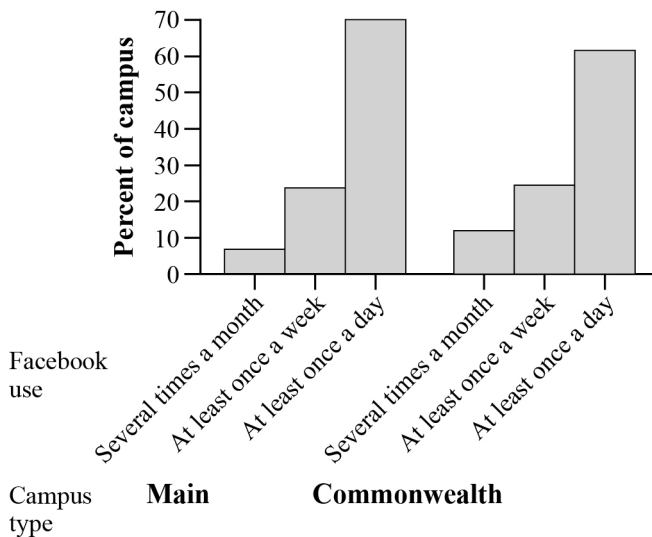


Section 11.2

Check Your Understanding, page 699:

1. For the main campus: $55/910 = 0.060$ use Facebook several times a month or less, $215/910 = 0.236$ use it at least once a week, and $640/910 = 0.703$ use it at least once a day. For the commonwealth campuses: $76/627 = 0.121$ use it several times a month or less, $157/627 = 0.250$ use it at least once a week, and $394/627 = 0.628$ use it at least once a day.
2. It is important to compare proportions rather than counts because there was such a big difference in the sample size from the two different types of campuses.
3. The biggest difference between the two types of campuses is that students on the main campus are more likely to be everyday users of Facebook than students on the commonwealth campuses. Also, those on the commonwealth campuses are more likely to use Facebook several times a month or less than those students on the main campus.



Check Your Understanding, page 705:

1. H_0 : There is no difference in the distributions of Facebook use among students at the main campus and students at the commonwealth campuses versus H_a : There is a difference in the distributions of Facebook use among students at the main campus and students at the commonwealth campuses.
2. First note that there are $910 + 627 = 1537$ total students in the two samples, $55 + 76 = 131$ total students who use Facebook several times a month or less, $215 + 157 = 372$ total students who use Facebook at least once a week, and $640 + 394 = 1034$ total students who use Facebook at least once a day. The expected counts are in the table below.

Use Facebook	Main campus	Commonwealth campus
Several times a month	$\frac{(131)(910)}{1537} = 77.56$	$\frac{(131)(627)}{1537} = 53.44$
Once a week	$\frac{(372)(910)}{1537} = 220.25$	$\frac{(372)(627)}{1537} = 151.75$
Once a day	$\frac{(1034)(910)}{1537} = 612.19$	$\frac{(1034)(627)}{1537} = 421.81$

$$3. \quad \chi^2 = \frac{(55 - 77.56)^2}{77.56} + \frac{(76 - 53.44)^2}{53.44} + \frac{(215 - 220.25)^2}{220.25} + \frac{(157 - 151.75)^2}{151.75} + \frac{(640 - 612.19)^2}{612.19} + \frac{(394 - 421.81)^2}{421.81} = 19.49$$

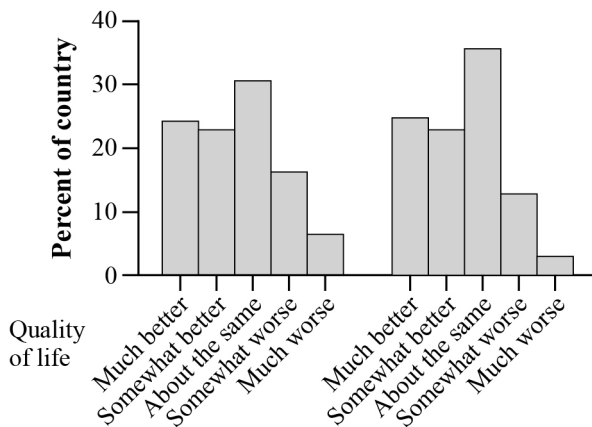
4. With $df = (3 - 1)(2 - 1) = 2$, the P -value is less than 0.0005. Using technology, $P\text{-value} = \chi^2 \text{cdf}(\text{lower: } 19.49, \text{upper: } 1000, df: 2) = 0.000059$.

5. Assuming that there is no difference in the distributions of Facebook use between students on Penn State's main campus and students at Penn State's commonwealth campuses, there is a 0.000059 probability of observing samples that show a difference in the distributions of Facebook use among students at the main campus and the commonwealth campuses as large or larger than the one found in this study.

6. Because the P -value of 0.000059 is less than $\alpha = 0.05$, we reject H_0 . There is convincing evidence that the distribution of Facebook use is different among students at Penn State's main campus and students at Penn State's commonwealth campuses.

Check Your Understanding, page 711:

1. The bar graph shows the conditional distribution of quality of life for Canada and the U.S.



Country **Canada** **U.S.**

2. *State:* We want to perform a test at the $\alpha = 0.01$ level of H_0 : There is no difference in the distribution of quality of life for patients who have suffered a heart attack in Canada and the U.S. versus H_a : There is a difference in the distribution of quality of life for patients who have suffered a heart attack in Canada and the U.S. *Plan:* We should use a chi-square test for homogeneity if the conditions are met. *Random:* The data came from independent random samples. *10%:* $n_1 = 311$ is less than 10% of all Canadian heart attack patients and $n_2 = 2165$ is less than 10% of all U.S. heart attack patients. *Large Counts:* All of the expected counts (shown below) are at least 5.

Quality of life	Canada	US
Much better	77.37	538.63
Somewhat better	71.47	497.53
About the same	109.91	765.09
Somewhat worse	41.70	290.30
Much worse	10.55	73.45

Do: The test statistic is $\chi^2 = \frac{(75 - 77.37)^2}{77.37} + \dots + \frac{(65 - 73.45)^2}{73.45} = 11.725$. With $df = (5 - 1)(2 - 1) = 4$, the P -value is between 0.01 and 0.02. Using technology: P -value = 0.0195. *Conclude:* Because the P -value of 0.0195 is greater than $\alpha = 0.01$, we fail to reject H_0 . There is not convincing evidence that there is a difference in the distribution of quality of life for heart attack patients in Canada and the United States.

Check Your Understanding, page 717:

1. *State:* We want to perform a test at the $\alpha = 0.01$ level of H_0 : There is no association between an exclusive territory clause and business survival versus H_a : There is an association between an exclusive territory clause and business survival. *Plan:* We should use a chi-square test for independence if the conditions are met. *Random:* The data are from a random sample. *10%:* We assume that $n = 170$ is less than 10% of all new franchise firms. *Large Counts:* All of the expected counts (shown below) are at least 5.

Exclusive territory	Yes	No
Success	102.74	20.26
Failure	39.26	7.74

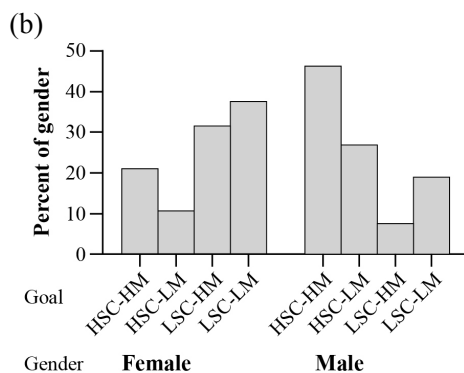
Do: The test statistic is $\chi^2 = \frac{(108 - 102.74)^2}{102.74} + \dots + \frac{(13 - 7.74)^2}{7.74} = 5.911$. Using $df = (2 - 1)(2 - 1) = 1$, the P -value is between 0.01 and 0.02. *Using technology:* P -value = 0.0150.

Conclude: Because the P -value of 0.0150 is greater than $\alpha = 0.01$, we fail to reject H_0 . There is not convincing evidence of an association between exclusive territory clause and business survival.

Exercises, page 724:

11.27 (a) There were 67 women and 67 men in the two samples, so the conditional distributions for females and males are:

Goal	Female	Male
HSC-HM	$14/67 = 0.209$	$31/67 = 0.463$
HSC-LM	$7/67 = 0.104$	$18/67 = 0.269$
LSC-HM	$21/67 = 0.313$	$5/67 = 0.075$
LSC-LM	$25/67 = 0.373$	$13/67 = 0.194$

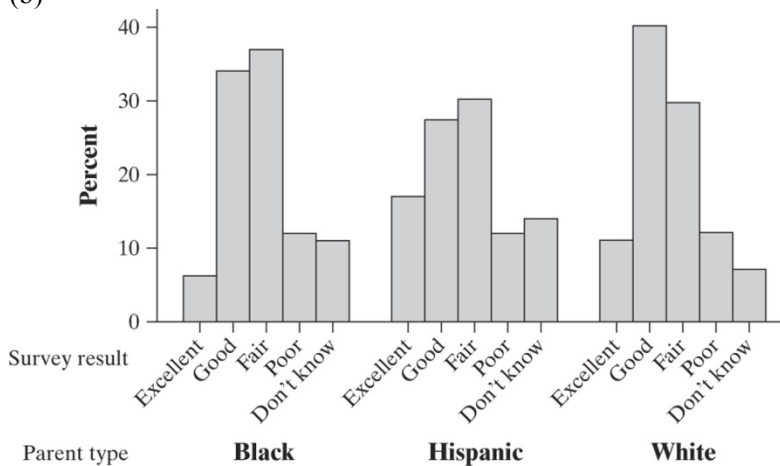


(c) In general it appears that females were classified mostly as low social comparison whereas males were classified mostly as high social comparison. However, about an equal percentage of males and females were classified as high mastery. Males were most likely to be in the high social comparison/high mastery group whereas females were most likely to be in the low social comparison/low social mastery group.

11.28 (a) The conditional distributions are:

Survey result	Black parents	Hispanic parents	White parents
Excellent	$12/202 = 0.059$	$34/202 = 0.168$	$22/201 = 0.109$
Good	$69/202 = 0.342$	$55/202 = 0.272$	$81/201 = 0.403$
Fair	$75/202 = 0.371$	$61/202 = 0.302$	$60/201 = 0.299$
Poor	$24/202 = 0.119$	$24/202 = 0.119$	$24/201 = 0.119$
Don't know	$22/202 = 0.109$	$28/202 = 0.139$	$14/201 = 0.070$

(b)



(c) In general, Hispanic parents are more likely to think that the high schools are doing an excellent job than white or black parents. White parents are more likely than either of the other two groups to think that the high schools are doing either an excellent or a good job. Black parents are more likely to think that schools are only doing a fair job than either of the other two groups of parents.

11.29 (a) H_0 : There is no difference in the distribution of sports goals for male and female undergraduates at this university versus H_a : There is a difference in the distribution of sports goals for male and female undergraduates at this university

(b) There are $67 + 67 = 134$ total students in the two samples, $14 + 31 = 45$ total students who are classified as HSC-HM, $7 + 18 = 25$ who are classified as HSC-LM, $21 + 5 = 26$ who are classified as LSC-HM, and $25 + 13 = 38$ who are classified as LSC-LM. The expected counts are:

Goal	Females	Males
HSC-HM	$\frac{(67)(45)}{134} = 22.5$	$\frac{(67)(45)}{134} = 22.5$
HSC-LM	$\frac{(67)(25)}{134} = 12.5$	$\frac{(67)(25)}{134} = 12.5$
LSC-HM	$\frac{(67)(26)}{134} = 13$	$\frac{(67)(26)}{134} = 13$
LSC-LM	$\frac{(67)(38)}{134} = 19$	$\frac{(67)(38)}{134} = 19$

$$(c) \chi^2 = \frac{(14 - 22.5)^2}{22.5} + \dots + \frac{(13 - 19)^2}{19} = 24.898.$$

11.30 (a) H_0 : There is no difference in the distribution of opinions about how high schools are doing among black, Hispanic, and white parents versus H_a : There is a difference in the distribution of opinions about how high schools are doing among black, Hispanic, and white parents.

(b) There are $202 + 202 + 201 = 605$ total parents in the three samples, $12 + 34 + 22 = 68$ total parents who said excellent, $69 + 55 + 81 = 205$ total parents who said good, $75 + 61 + 60 = 196$ total parents who said fair, $24 + 24 + 24 = 72$ total parents who said poor, and $22 + 28 + 14 = 64$ total parents who said don't know. The expected counts are given below.

Survey result	Black parents	Hispanic parents	White parents
Excellent	$\frac{(68)(202)}{605} = 22.70$	$\frac{(68)(202)}{605} = 22.70$	$\frac{(68)(201)}{605} = 22.59$
Good	$\frac{(205)(202)}{605} = 68.45$	$\frac{(205)(202)}{605} = 68.45$	$\frac{(205)(201)}{605} = 68.11$
Fair	$\frac{(196)(202)}{605} = 65.44$	$\frac{(196)(202)}{605} = 65.44$	$\frac{(196)(201)}{605} = 65.12$
Poor	$\frac{(72)(202)}{605} = 24.04$	$\frac{(72)(202)}{605} = 24.04$	$\frac{(72)(201)}{605} = 23.92$
Don't know	$\frac{(64)(202)}{605} = 21.37$	$\frac{(64)(202)}{605} = 21.37$	$\frac{(64)(201)}{605} = 21.26$

$$(c) \chi^2 = \frac{(12 - 22.70)^2}{22.70} + \dots + \frac{(14 - 21.26)^2}{21.26} = 22.426.$$

11.31 (a) Random: The data came from independent random samples. 10%: $n_1 = 67$ is less than 10% of all males and $n_2 = 67$ is less than 10% of all females at the university. Large

Counts: The expected counts computed in Exercise 29 are all at least 5.

(b) With $df = (4 - 1)(2 - 1) = 3$, the P -value is less than 0.0005. *Using technology:* P -value = 0.000016.

(c) Assuming that there is no difference in the distributions of goals for playing sports among males and females, there is a 0.000016 probability of observing independent random samples that show a difference in the distributions of goals for playing sports among males and females as large or larger than the one found in this study.

(d) Because the P -value of 0.000016 is less than $\alpha = 0.05$, we reject H_0 . There is convincing evidence of a difference in the distribution of goals for playing sports among male and female undergraduates at this university.

11.32 (a) Random: The data came from independent random samples. 10%: $n_1 = 202$ is less than 10% of all black parents, $n_2 = 202$ is less than 10% of all Hispanic parents, and $n_3 = 201$ is less than 10% of all white parents. Large Counts: The expected counts computed in Exercise 30 are all at least 5.

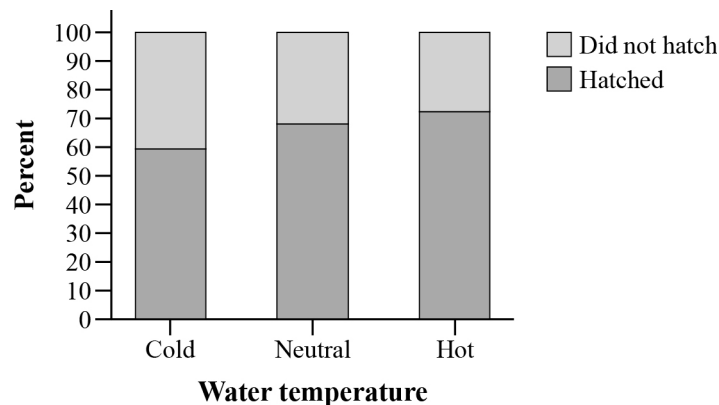
(b) With $df = (5 - 1)(3 - 1) = 8$, the P -value is between 0.0025 and 0.005. *Using technology,* P -value = 0.0042.

(c) Assuming that there is no difference in the distributions of opinions about how high schools are doing among black, Hispanic, and white parents, there is a 0.0042 probability of observing samples that show differences in the distributions of opinions as large or larger than the one found in this study.

(d) Because the P -value of 0.0042 is less than $\alpha = 0.05$, we reject H_0 . There is convincing evidence of a difference in the distribution of opinions about how high schools are doing among black, Hispanic, and white parents.

11.33 (a) The conditional distributions for each temperature are given in the table below along with a graph.

	Cold	Neutral	Hot
Yes	$16/27 = 0.593$	$38/56 = 0.679$	$75/104 = 0.721$
No	$11/27 = 0.407$	$18/56 = 0.321$	$29/104 = 0.279$



As the temperature warms up from cold to neutral to hot, the proportion of eggs that hatch appears to increase.

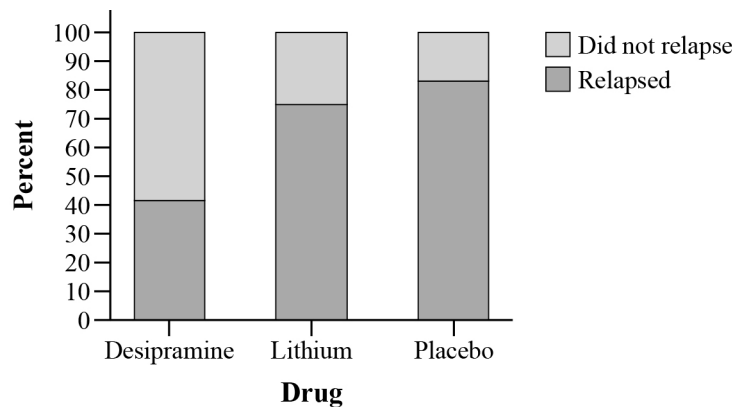
(b) *State:* We want to perform a test of H_0 : There is no difference in the true proportion of eggs that hatch in cold, neutral, or hot water versus H_a : There is a difference in the true proportion of eggs that hatch in cold, neutral, or hot water at the $\alpha = 0.05$ level. *Plan:* We should use a chi-square test for homogeneity if the conditions are met. *Random:* The data came 3 groups in a randomized experiment. *Large Counts:* The expected counts (shown below) are all at least 5.

	Cold	Neutral	Hot
Yes	18.63	38.63	71.74
No	8.37	17.37	32.26

Do: The test statistic is $\chi^2 = \frac{(16-18.63)^2}{18.63} + \dots + \frac{(29-32.26)^2}{32.26} = 1.703$. With $df = (2-1)(3-1) = 2$, the P -value is greater than 0.25. *Using technology:* P -value = 0.4267. *Conclude:* Because the P -value of 0.4267 is greater than $\alpha = 0.05$, we fail to reject H_0 . We do not have convincing evidence that there is a difference in the true proportions of eggs that hatch in cold, neutral, or hot water.

11.34 (a) The conditional distributions for each drug are given in the table below along with a graph.

Relapsed?	Desipramine	Lithium	Placebo
Yes	10/24 = 0.417	18/24 = 0.75	20/24 = 0.833
No	14/24 = 0.583	6/24 = 0.25	4/24 = 0.167



Patients who used desipramine had the lowest relapse rate, followed by lithium and then placebo.

(b) *State:* We want to perform a test of H_0 : There is no difference in the true proportion of cocaine addicts like these who relapse when using desipramine, lithium, or placebo versus H_a : There is a difference in the true proportion of cocaine addicts like these who relapse when using desipramine, lithium, or placebo at the $\alpha = 0.05$ level. *Plan:* We should use a chi-square test for homogeneity if the conditions are met. *Random:* The data came from 3 groups in a randomized experiment. *Large Counts:* The expected counts (shown below) are all at least 5.

	Desipramine	Lithium	Placebo
Yes	16	16	16
No	8	8	8

Do: The test statistic is $\chi^2 = \frac{(10-16)^2}{16} + \dots + \frac{(4-8)^2}{8} = 10.5$. With $df = (2-1)(3-1) = 2$, the P -value is between 0.005 and 0.01. *Using technology:* P -value = 0.0052. *Conclude:* Because the P -value of 0.0052 is less than $\alpha = 0.05$, we reject H_0 . We have convincing evidence that there is a difference in the true proportion of cocaine addicts like these who relapse when using desipramine, lithium, or placebo.

11.35 We cannot use a chi-square test with these data because we do not have the actual counts of the travelers in each category. We also do not know if the sample was taken randomly or if the samples are independent.

11.36 We cannot use a chi-square test because these data are quantitative. A chi-square test for homogeneity requires categorical data.

11.37 (a) The data are in the table below.

	Nicotine patch	Drug	Patch plus drug	Placebo	Total
Success	40	74	87	25	226
Failure	204	170	158	135	667
Total	244	244	245	160	893

The success rates are in the table below.

	Nicotine patch	Drug	Patch plus drug	Placebo
Success rate	$40/244 = 0.164$	$74/244 = 0.303$	$87/245 = 0.355$	$25/160 = 0.156$

The best success rate is for the patch plus the drug, followed by the drug alone. The patch alone is just a little better than the placebo.

(b) The null hypothesis given says that each of the four treatments has the same probability of success for smokers like these.

(c) *State:* We want to perform a test of H_0 : The true proportions of smokers like these who are able to quit for a year are the same for each of the four treatments versus H_a : The true proportions of smokers like these who are able to quit for a year are not the same for each of the four treatments at the $\alpha = 0.05$ level. *Plan:* We should use a chi-square test for homogeneity if the conditions are met. *Random:* The data came from 4 groups in a randomized experiment. *Large Counts:* The expected counts (shown below) are all at least 5.

	Nicotine patch	Drug	Patch plus drug	Placebo
Success	61.75	61.75	62	40.49
Failure	182.25	182.25	183	119.51

Do: The test statistic is $\chi^2 = \frac{(40-61.75)^2}{61.75} + \dots + \frac{(135-119.51)^2}{119.51} = 34.937$. With $df = (2-1)(4-1) = 3$, the P -value is less than 0.0005. *Using technology:* P -value ≈ 0 . *Conclude:* Because the P -value of approximately 0 is less than $\alpha = 0.05$, we reject H_0 . There is convincing evidence that the true proportions of smokers like these who are able to quit for a year are not the same for each of the four treatments.

11.38 (a) The data are in the table below.

	Placebo	Aspirin	Dipyridamole	Both	Total
Stroke	250	206	211	157	824
No stroke	1399	1443	1443	1493	5778
Total	1649	1649	1654	1650	6602

The stroke rates are in the table below.

	Placebo	Aspirin	Dipyridamole	Both
Stroke rate	250/1649 = 0.152	206/1649 = 0.125	211/1654 = 0.128	157/1650 = 0.095

The lowest stroke rate is for the subjects who took both aspirin and dipyridamole. The groups that had either aspirin alone or dipyridamole alone had about the same stroke rates. The highest stroke rate was for the group taking the placebo.

(b) The null hypothesis given says that each of the four treatments has the same stroke rate for patients like these.

(c) *State:* We want to perform a test of H_0 : The true proportions of patients like these who have a stroke are the same for each of the four treatments versus H_a : The true proportions of patients like these who have a stroke are not the same for each of the four treatments at the $\alpha = 0.05$ level. *Plan:* We should use a chi-square test for homogeneity if the conditions are met. *Random:* The data came from 4 groups in a randomized experiment. *Large Counts:* The expected counts (shown below) are all at least 5.

	Placebo	Aspirin	Dipyridamole	Both
Stroke	205.81	205.81	206.44	205.94
No stroke	1443.19	1443.19	1447.56	1444.06

Do: The test statistic is $\chi^2 = \frac{(250 - 205.81)^2}{205.81} + \dots + \frac{(1493 - 1444.06)^2}{1444.06} = 24.243$. With $df = (2 -$

$1)(4 - 1) = 3$, the P -value is less than 0.0005. *Using technology:* P -value ≈ 0 . *Conclude:*

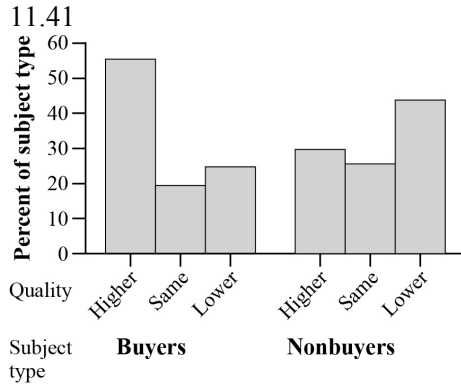
Because the P -value of approximately 0 is less than $\alpha = 0.05$, we reject H_0 . There is convincing evidence that the true proportions of patients like these who have a stroke are not the same for each of the four treatments.

11.39 The chi-square statistic breaks down into its individual components as follows:

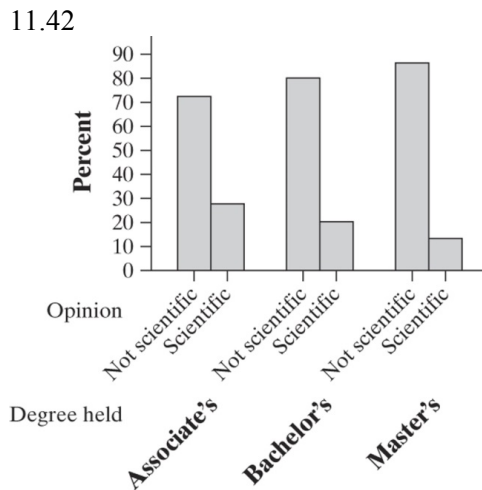
$\chi^2 = 7.662 + 2.596 + 2.430 + 0.823 + 10.076 + 3.414 + 5.928 + 2.008 = 34.937$. The largest component comes from those who had success using both the patch and the drug. Far more people fell in this group than would have been expected ($87 - 62 = 25$). The next largest component comes from those who had success using just the patch. Far fewer people were in this group than would have been expected ($40 - 61.75 = -21.75$).

11.40 The chi-square statistic breaks down into its individual components as follows:

$\chi^2 = 9.487 + 1.353 + 0 + 0 + 0.101 + 0.014 + 11.629 + 1.658 = 24.243$. The largest component comes from those who had strokes on both aspirin and dipyridamole. Far fewer people were in this group than would have been expected ($157 - 205.94 = -48.94$). The next largest component comes from those who had strokes while on the placebo. Far more people were in this group than would have been expected ($250 - 205.81 = 44.19$).



Buyers are much more likely to think the quality of recycled coffee filters is higher while nonbuyers are more likely to think the quality is the same or lower.



The higher the degree earned, the less likely people are to think that astrology is scientific.

11.43 (a) H_0 : There is no association between beliefs about the quality of recycled products and whether or not a person buys recycled products in the population of adults versus H_a : There is an association between beliefs about the quality of recycled products and whether or not a person buys recycled products in the population of adults.

(b) Here is a table of the expected counts:

	Buyers	Nonbuyers	Total
Higher	$\frac{(49)(36)}{133} = 13.26$	$\frac{(49)(97)}{133} = 35.74$	49
Same	$\frac{(32)(36)}{133} = 8.66$	$\frac{(32)(97)}{133} = 23.34$	32
Lower	$\frac{(52)(36)}{133} = 14.08$	$\frac{(52)(97)}{133} = 37.92$	52
Total	36	97	133

$$(c) \chi^2 = \frac{(20 - 13.26)^2}{13.26} + L + \frac{(43 - 37.92)^2}{37.92} = 7.64. \text{ With } df = (3 - 1)(2 - 1) = 2, \text{ the } P\text{-value is}$$

between 0.02 and 0.025. Using technology: $P\text{-value} = 0.022$.

(d) Because the $P\text{-value}$ of 0.022 is less than $\alpha = 0.05$, we reject H_0 . There is convincing evidence of an association between beliefs about the quality of recycled products and whether or not a person buys recycled products in the population of adults.

11.44 (a) H_0 : There is no association between level of education and opinion about astrology in the population of adults with some higher education versus H_a : There is an association between level of education and opinion about astrology in the population of adults with some higher education.

(b) Here is a table of the expected counts:

	Associate's	Bachelor's	Master's	Total
Not at all scientific	$\frac{(539)(234)}{687} = 183.59$	$\frac{(539)(321)}{687} = 251.85$	$\frac{(539)(132)}{687} = 103.56$	539
Very or sort of scientific	$\frac{(148)(234)}{687} = 50.41$	$\frac{(148)(321)}{687} = 69.15$	$\frac{(148)(132)}{687} = 28.44$	148
Total	234	321	132	687

$$(c) \chi^2 = \frac{(169 - 183.59)^2}{183.59} + L + \frac{(18 - 28.44)^2}{28.44} = 10.582. \text{ With } df = (2 - 1)(3 - 1) = 2, \text{ the } P\text{-value}$$

is between 0.005 and 0.01. Using technology: $P\text{-value} = 0.0050$.

(d) Because the $P\text{-value}$ of 0.0050 is less than $\alpha = 0.05$, we reject H_0 . There is convincing evidence of an association between level of education and opinion about astrology in the population of adults with some higher education.

11.45 *State*: We want to perform a test of H_0 : There is no association between education level and opinion about a handgun ban in the adult population versus H_a : There is an association between education level and opinion about a handgun ban in the adult population at the $\alpha = 0.05$ level. *Plan*: We should use a chi-square test for independence if the conditions are met. *Random*: The data came from a random sample. 10%: $n = 1201$ is less than 10% of all adults. *Large Counts*: All expected counts are at least 5 (see table below).

	Less than high school	High school grad	Some college	College grad	Postgraduate degree
Yes	46.94	86.19	187.36	94.29	71.22
No	69.06	126.81	275.64	138.71	104.78

$$\text{Do: The test statistic is } \chi^2 = \frac{(58 - 46.94)^2}{46.94} + \dots + \frac{(99 - 104.78)^2}{104.78} = 8.525. \text{ With } df =$$

$(2 - 1)(5 - 1) = 4$, the $P\text{-value}$ is between 0.05 and 0.10. Using technology: $\chi^2 = 8.525$, $df = 4$, $P\text{-value} = 0.0741$. *Conclude*: Because the $P\text{-value}$ of 0.0741 is greater than $\alpha = 0.05$, we fail to reject H_0 . We do not have convincing evidence that there is an association between educational level and opinion about a handgun ban in the adult population.

11.46 *State:* We want to perform a test of H_0 : There is no association between laundry practices and product preference for people who don't currently use the established brand versus H_a : There is an association between laundry practices and product preference for people who don't currently use the established brand at the $\alpha = 0.05$ level. *Plan:* We should use a chi-square test for independence if the conditions are met. *Random:* The data came from a random sample. 10%: $n = 354$ is less than 10% of the population who don't currently use the established brand. *Large Counts:* All expected counts are at least 5 (see table below).

Product preference	Soft, warm	Soft, hot	Hard, warm	Hard, hot
Standard	49.81	24.05	47.23	30.92
New	66.19	31.95	62.77	41.08

Do: The test statistic is $\chi^2 = \frac{(53 - 49.81)^2}{49.81} + \dots + \frac{(42 - 41.08)^2}{41.08} = 2.058$. With $df = (2 - 1)(4 - 1) = 3$, the P -value is greater than 0.25. *Using technology:* P -value = 0.5605. *Conclude:* Because the P -value of 0.5605 is greater than $\alpha = 0.05$, we fail to reject H_0 . We do not have convincing evidence that there is an association between laundry practices and product preference among people who don't currently use the established brand.

11.47 (a) Because the data come from a single random sample and the subjects were then classified by their answer and their gender, this would be a chi-square test for independence. (b) The hypotheses are H_0 : There is no association between gender and where people live in the population of young adults versus H_a : There is an association between gender and where people live in the population of young adults. (c) *Random:* The data come from a random sample. 10%: $n = 4854$ is less than 10% of all young adults. *Large Counts:* The expected counts provided in the output are all at least 5. (d) *P-value:* If there is no association between gender and where people live in the population of young adults, there is a 0.012 probability of getting a random sample of 4854 young adults with an association as strong or even stronger than the one found in this study. *Conclusion:* Because the P -value of 0.012 is less than $\alpha = 0.05$, we reject H_0 . There is convincing evidence that there is an association between gender and where people live in the population of young adults.

11.48 (a) Because there were two independent random samples, one of American students and one of Asian students, we should perform a chi-square test for homogeneity. (b) The hypotheses are H_0 : There is no difference in the distribution of reasons for shopping from catalogs for American and Asian students at this university versus H_a : There is a difference in the distribution of reasons for shopping from catalogs for American and Asian students at this university. (c) *Random:* The data came from independent random samples. 10%: $n_1 = 95$ is less than 10% of all American students at this university and $n_2 = 62$ is less than 10% of all Asian students at this university. *Large Counts:* The expected counts provided in the output are all at least 5. (d) *P-value:* If the distribution of reasons for shopping from catalogs is the same for both Asian and American students, there is a 0.0001 probability of finding distributions as different or even more different than the observed distributions by chance alone. *Conclusion:* Because the P -value of 0.0001 is less than $\alpha = 0.05$, we reject H_0 . There is convincing evidence that there is a difference in the distribution of reasons for shopping from catalogs among American and Asian students at this university.

11.49 (a) *Hypotheses:* H_0 : There is no difference in the improvement rates for patients like these who receive gastric freezing and those who receive the placebo versus H_a : There is a difference in the improvement rates for patients like these who receive gastric freezing and those who receive the placebo. *P-value:* Assuming that there is no difference in the improvement rates between those receiving gastric freezing and those receiving the placebo, there is a 0.570 probability of observing a difference in improvement rates as large or larger than the difference observed in the study by chance alone. *Conclusion:* Because the P -value of 0.570 is larger than $\alpha = 0.05$, we fail to reject H_0 . There is not convincing evidence that there is a difference in the improvement rates for patients like these who receive gastric freezing and those who receive the placebo.

(b) The P -value for this test is identical to the P -value for the test in part (a). Also, $z^2 = (-0.57)^2 = 0.3249 \approx \chi^2 = 0.322$.

11.50 (a) *Hypotheses:* H_0 : There is no difference in opinion about the death penalty among all people who only have a high school diploma and all those who have a bachelor's degree versus H_a : There is a difference in opinion about the death penalty among all people who only have high school diploma and all those who have a bachelor's degree. *P-value:* Assuming that there is no difference in opinion about the death penalty among all people who only have high school diploma and all those who have a bachelor's degree, there is a probability of approximately 0 of observing a difference in opinions as large or larger than the difference observed in the study by chance alone. *Conclusion:* Because the P -value of approximately 0 is less than $\alpha = 0.05$, we reject H_0 . There is convincing evidence that there is a difference in opinion about the death penalty among all people who only have high school diploma and all those who have a bachelor's degree.

(b) The P -value for this test is identical to the P -value for the test in part (a). Also, $z^2 = (4.19)^2 = 17.556 \approx \chi^2 = 17.590$.

11.51 d

11.52 e

11.53 d

11.54 a

11.55 a

11.56 c

11.57 (a) One-sample t interval for a mean.

(b) Two-sample z test for the difference between two proportions.

11.58 (a) Chi-square test for independence.

(b) Two-sample t interval for the difference between two means.

11.59 (a) This was an experiment because a treatment (type of rating scale) was deliberately imposed on the students who took part in the study.

(b) A chi-square test would not be appropriate here because several of the expected counts are less than 5. For example, the expected count for the lowest rating on the 1 to 5 scale is

$$\frac{(22)(2)}{50} = 0.88.$$

11.60 (a) The mean for the 1–5 scale is $\frac{1+1+2+L+5}{22} = 3.545$. The standard deviation is 1.184.

(b) The new mean for the 0–4 scale is $3.21 + 1 = 4.21$. Adding one to each of the values does not change the standard deviation, so it remains 0.568.

(c) We should not use a two-sample t test here because the Normal/Large Sample condition is not met. The sample sizes are both less than 30 and there are two low outliers in the distribution of responses for students who were given the 1–5 scale.